PATENT ABSTRACTS OF JAPAN

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(11)Publication number : 2001-122672
(43)Date of publication of application : 08.05.2001

(51)Int.Cl. C04B 35/83
B32B 18/00
C04B 41/88
G12B 15/06
H01L 23/373
H01L 23/36
H05K 1/02

(21)Application number : 11-298389
(22)Date of filing : 20.10.1999

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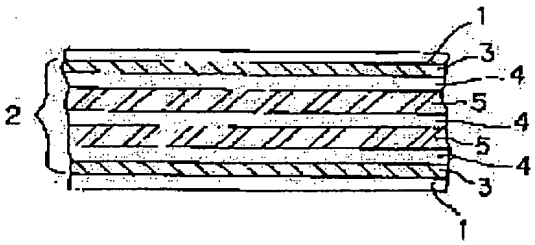
(54) MEMBER FOR HEATSINK AND ELECTRONIC SUBSTRATE MODULE FOR ELECTRONIC INSTRUMENT USING THE SAME AS HEATSINK

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a heatsink member lightweight, having high thermal conductivity and usable as a printed circuit substrate for an electronic instrument and to provide an electronic substrate module for the electronic instrument using the heatsink member as a heatsink.
SOLUTION: This heatsink member is a laminated body which is obtained using carbon fibers as raw materials and has such a layer structure that plural layers, which consist of carbon fibers different in characteristics and parallel with the direction of a heat absorbing member while interposing the center line, are laminated to be mirror-symmetric with one another. The internal layer part accounting for 40-25% of the layer structure by the volumetric ratio contains a series of layers that are obtained by laminating a layer of the carbon fibers adjusted so that the direction of the carbon fiber makes the angle of 45° with respect to the direction of the heat absorbing member or the thermal conductive direction. Both of the surface layer parts accounting for 60-75% of the layer structure by the volumetric ratio are constituted of carbon fiber bundles arranged so that the direction of the carbon fiber is in parallel with the direction of the heat absorbing member or the thermal conductive direction. Copper is impregnated in the pores at least on the outermost surface of the surface layer part.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号
特開2001－122672
（P2001－122672A）
(43)公開日　平成13年５月８日(2001.5.8)

(51)Int.Cl.'	識別記号	ＦＩ		テーマコード'（参考）
Ｃ０４Ｂ　35/83		Ｂ３２Ｂ　18/00	Ａ	２Ｆ０７８
Ｂ３２Ｂ　18/00		Ｃ０４Ｂ　41/88	Ｖ	４Ｆ１００
Ｃ０４Ｂ　41/88		Ｇ１２Ｂ　15/06		４Ｇ０３２
Ｇ１２Ｂ　15/06		Ｈ０５Ｋ　1/02	Ｆ	５Ｅ３３８
Ｈ０１Ｌ　23/373		Ｃ０４Ｂ　35/52	Ｅ	５Ｆ０３６

審査請求　未請求　請求項の数５　ＯＬ　（全５頁）　最終頁に続く

(21)出願番号　特願平11－298389

(22)出願日　平成11年10月20日(1999.10.20)

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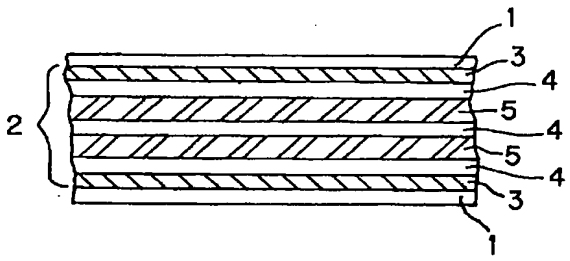
最終頁に続く

(54)【発明の名称】　ヒートシンク用部材、および同部材をヒートシンクとして使用した電子機器用電子基板モジュール

(57)【要約】
【課題】　軽量で、かつ、高い熱伝導度を有する電子機器用プリント配線基板用として使用可能なヒートシンク用部材、および同ヒートシンク用部材をヒートシンクとして使用した、電子機器用電子基板モジュールの提供。
【解決手段】　炭素繊維を原料とする積層体であって、その層構造は、熱を吸収する部材方向に平行な中心線を挟んで性質の異なる炭素繊維からなる複数の層が鏡面対称となるように積層された構造であって、体積比でその構造の４０～２５％を占める積層体内層部は、熱を吸収する部材方向、あるいは、熱の伝導方向に対して炭素繊維の繊維の方向が±４５°となるように調製された炭素繊維からなる層が積層された一連の層を含み、また、体積比で同構造の６０～７５％を占める両表層部は、熱を吸収する部材方向、あるいは、熱の伝導方向に対して炭素繊維の繊維の方向が平行に並べられた炭素繊維束から構成され、少なくとも表層部の最表面の空隙は銅が含浸されている積層体により課題達成。



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【特許請求の範囲】

【請求項１】　炭素繊維を原料とする積層体であって、その層構造は、熱を吸収する部材方向に平行な中心線を挟んで性質の異なる炭素繊維からなる複数の層が鏡面対称となるように積層された構造であって、体積比でその構造の４０～２５％を占める積層体内層部は、熱を吸収する部材方向、あるいは、熱の伝導方向に対して炭素繊維の繊維の方向が±４５°となるように調製された炭素繊維からなる層が積層された一連の層を含み、また、体積比で同構造の６０～７５％を占める両表層部は、熱を吸収する部材方向、あるいは、熱の伝導方向に対して炭素繊維の繊維の方向が平行に並べられた炭素繊維束から構成され、少なくとも表層部の最表面の空隙は銅が含浸されている積層体からなることを特徴とするヒートシンク用部材。

【請求項２】　炭素が６５重量%～８５重量%を占め、残部がＣｕまたは銅合金からなることを特徴とする請求項１に記載のヒートシンク用部材。

【請求項３】　該内層部が熱を吸収する部材方向、あるいは、熱の伝導方向に対して炭素繊維の繊維の方向が－４５°に配置された炭素繊維製シートを、熱を吸収する部材方向、あるいは、熱の伝導方向に対して炭素繊維の繊維の方向が平行に並べられた炭素繊維束からなるシートを介して、熱を吸収する部材方向、あるいは、熱の伝導方向に対して炭素繊維の繊維の方向が＋４５°に配置された炭素繊維製シートからなる層を積層した層を少なくとも一層含んでなることを特徴とする請求項１または２に記載のヒートシンク用部材。

【請求項４】　熱伝導度が少なくとも３００Ｗ／ｍ・Ｋ、で、比重が１．９～２．９ｇ／ｃｍ'であることを特徴とする請求項１～３のいずれか１項に記載のヒートシンク用部材。

【請求項５】　請求項１～４のいずれか１項に記載のヒートシンク用部材をヒートシンクとして使用した、電子機器用電子基板モジュール。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】　本発明は、軽量でかつ熱伝導度の高いヒートシンク用部材、および同ヒートシンク用部材をヒートシンクとして使用した、電子機器用電子基板モジュールに関する。特に、高度９０ｋｍ以上の高々度空間で使用される各種機材に装着される電子機器用プリント配線基板用モジュールとして好適に使用可能な、軽量でかつ熱伝導度の高いヒートシンク用部材に関する。

【０００２】

【従来の技術】　高度９０ｋｍ以上の高々度空間で使用される各種機材に装着される電子機器用電子基板モジュール、特に、ヒートシンク機能を有する電子機器用電子基板モジュールとしては、その軽量性から、アルミニウム製基板モジュールが使用されている。しかしより実装密度が上がるに従って、肉厚化して、ヒートシンクとしての所望とする性能が発揮されないことから、重量の点では、アルミニウム製のものと比較して劣るものの、より熱伝導度が高いことから銅製の基板モジュールが使用される様になってきている。しかし、銅の場合においても、重量の点で問題を有している。特に、宇宙帰還機等のように、そのトン当たり打ち上げコストが２０億円を超すと言われている場合には、グラム単位での軽量化を目的として必死の努力がはかられているのが現状である。その点では、更に軽量化が望まれている。軽量性の観点から、一部には、ＣＦＲＰと称される炭素繊維で強化したプラスチック製の基板モジュールも使用されているが、炭素繊維とプラスチックとの間の熱伝導度の差異が大きく、熱の移動速度の点で、充分な性能を発揮することができないのが現状である。一方、熱伝導の速度の点ばかりでなく、熱伝導効率の点から、熱がヒートシンク用部材の表面をその長手方向に瞬時に移動できる性質を有する部材の出現が望まれている。

【０００３】

【発明が解決しようとする課題】　本発明は、軽量で、かつ、高い熱伝導度を有する電子機器用プリント配線基板用として使用可能なヒートシンク用部材、および同ヒートシンク用部材をヒートシンクとして使用した、電子機器用電子基板モジュールを提供することを目的とするものである。

【０００４】

【課題を解決するための手段】　本発明者等は、上記の様な現状に鑑みて種々検討した結果、特定の積層構造を有するＣ／Ｃコンポジットに、所定量の銅を含浸させた部材が、機械的強度にも優れ、軽量でしかも高い熱伝導度を有することを見いだした本発明を完成させたものである。すなわち、本発明によれば、炭素繊維を原料とする積層体であって、その層構造は、熱を吸収する部材方向に平行な中心線を挟んで性質の異なる炭素繊維からなる複数の層が鏡面対称となるように積層された構造であって、体積比でその構造の４０～２５％を占める積層体内層部は、熱を吸収する部材方向、あるいは、熱の伝導方向に対して炭素繊維の繊維の方向が±４５°となるように調製された炭素繊維からなる層が積層された一連の層を含み、また、体積比で同構造の６０～７５％を占める両表層部は、熱を吸収する部材方向、あるいは、熱の伝導方向に対して炭素繊維の繊維の方向が平行に並べられた炭素繊維束から構成され、少なくとも一部の層の、あるいは表層部の最表面の空隙は銅が含浸されている、積層体が提供されることとなる。

【０００５】

【発明の実施の形態】　本発明に係るヒートシンク用部材は、Ｃｕを含浸させたいわゆるＣ／Ｃコンポジットからなる複合材料から構成される。本発明に係るヒートシ

ンク用部材を製造するに際しては、所望の層構成を有する炭素繊維からなる層の積層体からなる成形体の焼成体に、以下に記載する方法により、Ｃｕを含浸させることにより容易に製造できる。炭素繊維からなる層として使用する炭素繊維シートは、以下のような手順で調製する。炭素繊維に、マトリックスとして作用する粉末状のバインダーであって、焼成後には炭素繊維の束に対して遊離炭素となるピッチ、コークス類を包含させ、さらに、必要に応じてフェノール樹脂粉末等を含有させることによって、炭素繊維束を調製し、この炭素繊維束の周囲に、熱可塑性樹脂等のプラスチックからなる柔軟な被膜を形成し、柔軟性中間材としてのプレフォームドヤーンを得る。このプレフォームドヤーンを、繊維方向を所望の方向に引き揃えた後、特開平２－８０６３９号公報に記載されている方法によりシートまたはクロスに加工して、このシートまたはクロスを、ヒートシンク用部材を製造したときの長手方向を中心として鏡面対称となるように、所望の層構造をなすように積層した後、ホットプレスして成形すればよい。なお、クロスは、熱の移動方向を長手方向にのみ制御することが困難なので、表層部には使用しないことが好ましい。また、焼成体は、かくして得られた成形体を焼成して得ることができる。

【０００６】　ところで、本発明に係る電子機器用プリント配線基板モジュールとして使用可能なヒートシンク部材は、熱を吸収する部材方向、あるいは、熱の伝導方向に対して炭素繊維の繊維の方向が±４５°となるように調製された炭素繊維からなる層が積層された一連の層を含む内層部と、熱を吸収する部材方向、あるいは、熱の伝導方向に対して平行に並べられた炭素繊維束から構成される表層部とから構成される複数の層からなる層構造が、同部材の長手方向に平行である中心線を挟んで鏡面対称となるように積層された構造からなり、内層部は体積比でその構造の４０～２５％を占め、両表層部は相互に同一構成を有し、両者は合計で、体積比でその構造の６０～７５％を占め、少なくとも一部の層の、あるいは、表層部の最表面の空隙は銅が含浸されている積層体である。従って、その積層方法について、以下詳述することとする。

【０００７】　表層部は、炭素繊維方向がヒートシンク用部材として使用するときの熱を吸収する部材方向に平行に引き揃えられた、炭素繊維束からなるシートから構成すればよい。表層部は、表面を構成する表層部と裏面を構成する表層部とから構成され、両面とも同じ構成からなり、厚さも同一であることが必要である。従って、当然のことながら、表面と裏面は、それぞれが部材の３０～３７．５％の範囲内で同一の割合を占めるように構成する必要がある。表層部は、熱を吸収する部材方向、あるいは、熱の伝導方向に対して平行に並べられた炭素繊維束から構成されるシートからなる。炭素繊維の繊維の方向が、熱を吸収する部材方向、あるいは、熱の伝導方向に対して平行であることから、以下０°シートと略称する。内層部には、熱を吸収する部材方向、あるいは、熱の伝導方向に対して±４５°で積層された一連の層を含むことが部材そのものの強度を保持するためには必要である。

【０００８】　ところで、熱を吸収する部材方向、あるいは、熱の伝導方向に対して炭素繊維の繊維の方向が±４５°となるように調製された炭素繊維からなる層が積層された一連の層を含むとは、例えば、熱を吸収する部材方向、あるいは、熱の伝導方向に対して炭素繊維の繊維の方向が－４５°に配置された炭素繊維製シートを、０°シートを介して／または介さずに、熱を吸収する部材方向、あるいは、熱の伝導方向に対して炭素繊維の繊維の方向が＋４５°に配置された炭素繊維製シートからなる層を少なくとも一層含むことをいう。なお、以下、熱を吸収する部材方向、あるいは、熱の伝導方向に対して炭素繊維の繊維の方向が－４５°に配置された炭素繊維製シートを－４５°シートといい、また、熱を吸収する部材方向、あるいは、熱の伝導方向に対して炭素繊維の繊維の方向が＋４５°に配置された炭素繊維製シートを＋４５°シートという。

【０００９】　ここで、＋とは、繊維の方向が右上がりに熱を吸収する部材方向、あるいは、熱の伝導方向の中心線に対して４５°の角度で引き揃えられたものをいい、－とは、繊維の方向が左上がりに熱を吸収する部材方向、あるいは、熱の伝導方向の中心線に対して４５°の角度で引き揃えられたものをいう。内層部の層の積層例を挙げれば、０°シート、＋４５°シート、０°シート、－４５°シート、０°シートの順で積層されたものが挙げられる。内層部の厚さは、ヒートシンク用部材の用途に応じて、内層部が全体の４０～２５％を占めることができる範囲内で、適宜選択すればよく、内層部として厚いものを使用する場合には、例えば、０°シート、＋４５°シート、０°シート、－４５°シート、０°シート、０°シート、＋４５°シート、０°シート、－４５°シート、０°シートの順で積層したもの等が使用可能である。上記の積層例は、あくまでも例示であり、内層部が少なくとも熱を吸収する部材方向、あるいは、熱の伝導方向に対して炭素繊維の繊維の方向が±４５°となるように調製された炭素繊維からなる層が積層された一連の層を含み、層全体の構成が、同部材の熱を吸収する部材方向、あるいは、熱の伝導方向に平行である中心線を挟んで鏡面対称となるように積層された構造からなる様に積層されておれば、いかなる積層順序で積層されていてもよい。勿論、ヒートシンク用部材の用途によっては、０°シートの代わりに、クロスを使用してもよい場合がある。

【００１０】　熱を吸収する部材方向に平行な中心線を挟んで異なる炭素繊維からなる複数の層が鏡面対称となるように積層された構造とするには、表層部１層と熱を

吸収する部材方向、あるいは、熱の伝導方向に対して炭素繊維の繊維の方向が±４５°となるように引き揃えられた炭素繊維からなる層から積層された一連の層を含む内層部とから構成された同じ層構成を有する中間部材を２個用いて、表層部を形成する層を外側に、内層部を形成する面が互いに向かい合わせになるように炭素系接着剤層を介して重ね合わせ、調製してもよい。あるいは、内層部と表層部とを構成する部材をそれぞれ独立して調製し、２個の表層部を構成する部材で内層部を構成する部材を、炭素系接着剤層を介して、挟持させて調製してもよい。勿論、順次一層一層積層して調製しても差し支えない。換言すれば、部材を構成する層が鏡面対称となるように積層されていれば、層構成の形成方法には、特別な制限がある訳ではない。かくして調製した、積層体をプレス加工して、成形体を得る。

【００１１】　Ｃｕを含浸させる際には、上記成形体を窒素雰囲気中で適当な温度、例えば、２０００℃で焼成させ、得られた焼成体、すなわち、Ｃ／Ｃコンポジットとｃｕ粉末を相互に接触させずに同一炉内で加熱し、Ｃｕ粉末が溶融した時点で、両者を接触させると共に、同時に高圧力をかけて溶融した銅をＣ／Ｃコンポジットに含浸させ、直ちに冷却すればよい。あるいは、予め用意した焼成体（Ｃ／Ｃコンポジット）とＣｕ粉末を相互に接触させずに同一炉内で加熱し、Ｃｕ粉末が溶融した時点で、両者を接触させると共に、同時に高圧力をかけて溶融した銅を焼成体に含浸させ、直ちに冷却すればよい。炭素繊維とＣｕとは，塗れ性がよくないので，予め，焼成前に銅と炭素繊維との濡れ性改良材としてのＢｅ、Ａｌ、Ｓｉ、Ｍｇ、ＴｉおよびＮｉから選ばれた少なくとも一種類の金属で炭素繊維を塗布しておくことが好ましい。これらの金属の使用量は、炭素繊維に対して最大１重量%迄である。なお、Ｃｕの含浸は、出願人の一人の日本ガイシ株式会社の平成１０年９月１８日付の出願に係る特願平１０－２６５１３１号明細書に開示された方法により行うことができるので、参考までに、ここに引用する。

【００１２】　従って、本発明に係る電子機器用電子基板モジュールとして使用可能なヒートシンク部材であるＣｕを含浸させた複合材料は、特定の層構成を有する炭素繊維と炭素繊維以外の炭素成分とから構成された骨格部と、同骨格部の表層部の少なくとも最表層部にＣｕを含浸させて形成したＣｕからなるマトリックスとからなる複合材料と定義することができる。通常は、部材は、炭素が６５重量%～８５重量%を占め、残部がＣｕまたは銅合金からなる。なお、上記以外に、銅と炭素繊維との濡れ性改良材として使用されるＢｅ、Ａｌ、Ｓｉ、Ｍｇ、ＴｉおよびＮｉから選ばれた少なくとも一種類の金属と、不可避的不純物として含まれることのあるＣａ、Ａｇ、Ｃｄ、Ｚｎ、Ａｕ、Ｐｄ、Ｇａ、Ｐｔ、Ｃｒ、Ｇｅ、Ｒｈ、Ｓｂ、Ｉｒ、Ｃｏ、Ａｓ、Ｚｒ、Ｆｅ、Ｓｎ、Ｎｉ、Ｐ、Ｐｂ等を含んでいてもよい。前記マトリックスと前記骨格部とは一体的に形成されており、熱伝導度が少なくとも３００Ｗ／ｍ・Ｋ、好ましくは、４００Ｗ／ｍ・Ｋ以上、より好ましくは、５００Ｗ／ｍ・Ｋ以上で、比重も１．９～２．９ｇ／ｃｍ³と軽量で、熱伝導度の高い部材である。

【００１３】　また、本発明に係るヒートシンク用部材として有用なＣｕを含浸させた複合材料は、骨格部として、各炭素繊維が炭素繊維束から構成されているＣ／Ｃコンポジットを用いており、炭素繊維としての構造が、破壊されることなく保持されているために、骨格部を構成するＣ／Ｃコンポジットの有する機械的強度がほぼ保持されているという特徴を有している。しかも、少なくとも表層部の最表面の空隙には、Ｃｕからなるマトリックスが形成された複合構造を有している。なお、各種機材に装着される電子機器用電子基板モジュール、特に、高度９０ｋｍ以上の高々度空間で使用されるヒートシンク機能を有する電子機器用電子基板として使用するには、それぞれの基本仕様に従い加工すればよい。

【００１４】

【実施例】　以下に、本発明に係るヒートシンク用部材の製造例を挙げて、本発明を説明するが、本発明は、この製造例により何ら制限されるものでなく、本発明の趣旨を逸脱しない範囲内で、修飾、変更可能なことは言うまでもない。

【００１５】（製造例）炭素繊維を一方向に引き揃えたものにフェノール樹脂を含浸させ、直径１０μｍの炭素長繊維を約１万本束ね、繊維束（ヤーン）を得、このヤーンを簾状にしたヤーン配列体（プリプレグシート）を作り、このものから、厚さが１５０μｍの０°シート、＋４５°シート、および－４５°シートをそれぞれ必要枚数調製した。内層部としては、０°シート、＋４５°シート、０°シート、－４５°シート、０°シートの順で積層したものを使用した。この内層部の両表面に０°シートを３枚重ねて調製した２個の表層部をそれぞれの表面に表層部が配置されるように積層し、この積層体の上から炭素系接着剤を塗布し、ヤーン同士を固着した。固着後、型から固着体を離型させ、積層体をオーブン中に入れ、含浸させたフェノール樹脂を１８０℃、常圧で硬化させた後、窒素雰囲気中で２０００℃で焼成した。

【００１６】　次いで得られたこの焼成体と、Ｃｕ粉末とを相互に接触させずに同一炉内で加熱し、Ｃｕ粉末が溶融した時点で、両者を接触させると共に、同時に高圧力をかけて溶融した銅を焼成体に含浸させ、直ちに冷却して製造して、ヒートシンク用部材を調製した。このものの熱伝導度は、３５０Ｗ／ｍ・Ｋで、比重は、２．５ｇ／ｃｍ³であつた。このものから、ヒートシンク機能を有する電子機器用電子基板を標準仕様に従い製造した。熱伝導度について試験したところ、極めて良好な熱伝導性を示した。

【００１７】

【発明の効果】　本発明に係るヒートシンク用部材は、骨格部が炭素繊維で構成されている為に、軽量であり、かつ、熱伝導度も高い。特に、表面に熱を吸収する部材方向、あるいは、熱の伝導方向に対して平行に並べられた炭素繊維束から構成される表層部が設けられているために、熱が表面から熱を吸収する部材方向、あるいは、熱の伝導方向に瞬時に移動することができるという優れた特質を有している。特に、骨格部がＣ／Ｃコンポジットから構成されているので、耐熱性にも富むため高度９＊10＊０ｋｍ以上の高々度空間で使用される各種機材に装着される電子機器用電子基板用モジュールとして好適に使用可能である。

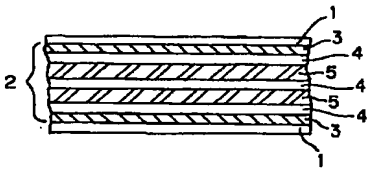
【図面の簡単な説明】

【図１】　本発明に係るヒートシンク用部材の層構造の一例を示す模式図である。

【符号の説明】

１…表層部、２…内層部、３…－４５°シート、４…０°シート、５…＋４５°シート。

【図１】



フロントページの続き

(51)Int.Cl.'	識別記号	FI	テーマコード'(参考)
Ｈ０１Ｌ　23/36		Ｈ０１Ｌ　23/36	Ｍ
Ｈ０５Ｋ　1/02			Ｚ

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Ｆターム(参考)　2F078 GA05 GB16 GB18
4F100 AB17A AB17E AB31A AB31E AD11A AD11B AD11C AD11D AD11E AK33 BA05 BA14 BA22 EJ31A EJ31E EJ48 EJ82A EJ82E GB43 JJ01 JJ01B JJ01D JJ05C JL03 YY00
4G032 AA44 AA52 BA04 GA06
5E338 AA00 BB71 EE02
5F036 AA01 BB01 BD11

JAPANESE [JP,2001-122672,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

* NOTICES *

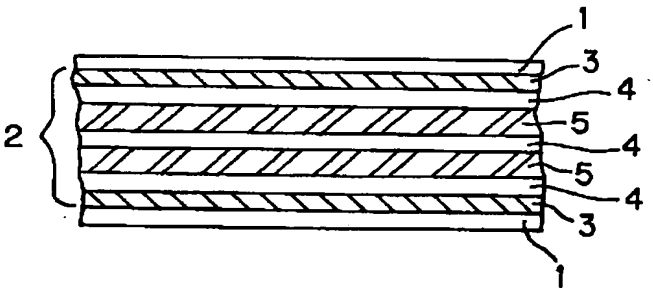
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] It is the layered product which uses a carbon fiber as a raw material. The layer structure It is the structure by which the laminating was carried out so that two or more layers which consist of a carbon fiber from which a property differs on both sides of a center line parallel to the direction of a member which absorbs heat might serve as mirror symmetry. The direction of a member where the layered product inner layer section which occupies 40 - 25% of the structure by the volume ratio absorbs heat, Or the layer which consists of a carbon fiber prepared so that the direction of the fiber of a carbon fiber might become **45 degrees to the conduction direction of heat contains a series of layers by which the laminating was carried out. Moreover, the direction of a member where both the surface section that occupies 60 - 75% of this structure by the volume ratio absorbs heat, Or it is the member for heat sinks which consists of carbon fiber bundles with which the direction of the fiber of a carbon fiber was compared in parallel to the conduction direction of heat, and is characterized by the opening on the front face of the maximum of the surface section consisting of a layered product into which copper sinks at least.
[Claim 2] The member for heat sinks according to claim 1 characterized by for carbon occupying 65 % of the weight - 85 % of the weight, and the remainder consisting of Cu or a copper alloy.
[Claim 3] The direction of a member where this inner layer section absorbs heat, Or the direction of a member which absorbs heat for the sheet made from a carbon fiber with which the direction of the fiber of a carbon fiber has been arranged to the conduction direction of heat at -45 degrees, Or the direction of a member which absorbs heat through the sheet which consists of a carbon fiber bundle with which the direction of the fiber of a carbon fiber was compared in parallel to the conduction direction of heat, Or the member for heat sinks according to claim 1 or 2 characterized by coming at least to contain the layer which carried out the laminating of the layer which consists of a sheet made from a carbon fiber with which the direction of the fiber of a carbon fiber has been arranged to the conduction direction of heat at +45 degrees further.
[Claim 4] the member for heat sinks given in any 1 term of claims 1-3 which thermal conductivity comes out at least 300 W/m-K, and are characterized by specific gravity being 1.9 - 2.9 g/cm3.
[Claim 5] The electronic substrate module for electronic equipment which used the member for heat sinks of a publication for any 1 term of claims 1-4 as a heat sink.

[Translation done.]

Drawing selection Representative drawing



[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the electronic substrate module for electronic equipment which used the lightweight member for heat sinks with high thermal conductivity, and the member for the said heat sinks as a heat sink. especially -- the altitude of 90km or more -- at most -- whenever -- space -- using it -- having -- various kinds -- equipments -- equipping -- having -- electronic equipment -- ** -- a printed-circuit board -- ** -- a module -- ****** -- suitable -- being usable -- it is lightweight and is related with the member for heat sinks with high thermal conductivity.
[0002]
[Description of the Prior Art] the altitude of 90km or more -- at most -- whenever -- space -- using it -- having -- various kinds -- equipments -- equipping -- having -- electronic equipment -- ** -- as an electronic substrate module and an electronic substrate module for electronic equipment which has a heat sink function especially, the substrate module made from aluminum is used from the lightweight nature. However, it is made thick, and since the engine performance considered as the request as a heat sink is not demonstrated, although it is inferior as compared with the thing made from aluminum, at the point of weight, a copper substrate module is increasingly used from heat conductivity being more high, as packaging density goes up more. However, in the case of copper, it has the problem in respect of weight. The present condition is that desperate efforts are especially aimed at for the purpose of lightweight-izing in a gram unit like a space feedback machine when it is said that launch cost exceeds 2 billion yen per the ton. At the point, lightweight-ization is desired further. Although the substrate module made from plastics strengthened with the carbon fiber called CFRP is also used for the part from a viewpoint of lightweight nature, the difference in the thermal conductivity between a carbon fiber and plastics is large, and is the point of the passing speed of heat, and the present condition is being unable to demonstrate sufficient engine performance. An appearance of the member which, on the other hand, has the property in which heat can move the front face of the member for heat sinks to the longitudinal direction in an instant, from the point of not only the point of the rate of heat conduction but heat-conduction effectiveness is desired.
[0003]
[Problem(s) to be Solved by the Invention] This invention aims at offering the electronic substrate module for electronic equipment which used the member for heat sinks usable as an object for electronic equipment for printed-circuit boards which has high thermal conductivity lightweight, and the member for the said heat sinks as a heat sink.
[0004]
[Means for Solving the Problem] this invention person etc. excels [member / into which the copper of the specified quantity was infiltrated] also in a mechanical strength, and makes the C/C composite which has a specific laminated structure complete this invention which found out having thermal conductivity lightweight and high moreover, as a result of examining many things in view of the above present condition. According to this invention, it is the layered product which uses a carbon fiber as a

raw material. Namely, the layer structure It is the structure by which the laminating was carried out so that two or more layers which consist of a carbon fiber from which a property differs on both sides of a center line parallel to the direction of a member which absorbs heat might serve as mirror symmetry. The direction of a member where the layered product inner layer section which occupies 40 - 25% of the structure by the volume ratio absorbs heat, Or the layer which consists of a carbon fiber prepared so that the direction of the fiber of a carbon fiber might become **45 degrees to the conduction direction of heat contains a series of layers by which the laminating was carried out. Moreover, the direction of a member where both the surface section that occupies 60 - 75% of this structure by the volume ratio absorbs heat, Or it will consist of carbon fiber bundles with which the direction of the fiber of a carbon fiber was compared in parallel to the conduction direction of heat, and, as for the opening on some [at least] layers or the front face of the maximum of the surface section, the layered product into which copper sinks will be offered.

[0005]

[Embodiment of the Invention] The member for heat sinks concerning this invention consists of composite material which consists of the so-called C/C composite into which Cu was infiltrated. It faces manufacturing the member for heat sinks concerning this invention, and can manufacture easily by infiltrating Cu by the approach of indicating below on the baking object of the Plastic solid which consists of a layered product of the layer which consists of a carbon fiber which has desired lamination. The carbon fiber sheet used as a layer which consists of a carbon fiber is prepared in the following procedures. By making the pitch which is the powder-like binder which acts on a carbon fiber as a matrix, and serves as free carbon to the bundle of a carbon fiber after baking, and corks include, and making phenol resin powder etc. contain further if needed, a carbon fiber bundle is prepared, the flexible coat which consists of plastics, such as thermoplastics, around this carbon fiber bundle is formed, and preform DOYAN as flexibility middle material is obtained. What is necessary is to carry out a hotpress and just to fabricate, after carrying out [after lengthening and arranging this preform DOYAN towards a request of a grain direction,] a laminating so that it may process a sheet or a cross by the approach indicated by JP,2-80639,A, and it may become mirror symmetry focusing on the longitudinal direction when manufacturing the member for heat sinks about this sheet or cross, and desired layer structure may be made. In addition, since a cross is difficult to control the migration direction of heat only to a longitudinal direction, it is desirable not to use it for the surface section. Moreover, a baking object can calcinate and acquire the Plastic solid acquired in this way.

[0006] By the way, the direction of a member where a heat sink member usable as a printed-circuit board module for electronic equipment concerning this invention absorbs heat, Or the inner layer section in which the layer which consists of a carbon fiber prepared so that the direction of the fiber of a carbon fiber might become **45 degrees to the conduction direction of heat contains a series of layers by which the laminating was carried out, The layer structure which consists of two or more layers which consist of the surface sections which consist of carbon fiber bundles put in order in parallel to the direction of a member which absorbs heat, or the conduction direction of heat It consists of structure by which the laminating was carried out so that it may become mirror symmetry on both sides of a center line parallel to the longitudinal direction of said division material, and the inner layer section occupies 40 - 25% of the structure by the volume ratio, both the surface section has the same configuration mutually, and both are the sum totals. Occupying 60 - 75% of the structure by the volume ratio, the opening on some [at least] layers or the front face of the maximum of the surface section is a layered product into which copper sinks. Therefore, suppose that it explains in full detail below about the laminating approach.

[0007] What is necessary is for the surface section just to consist of sheets which consist of a carbon fiber bundle which lengthened in parallel with the direction of a member which absorbs heat in case the direction of a carbon fiber uses it as a member for heat sinks, and was arranged. It consists of the surface section which constitutes a front face, and the surface section which constitutes a rear face, both sides consist of the same configuration, and the surface section needs for thickness to be also the same. Therefore, it is necessary to constitute so that, as for a front face and a rear face, each may account for the same rate within the limits of 30 - 37.5% of a member with a natural thing. The surface section

consists of a sheet which consists of carbon fiber bundles put in order in parallel to the direction of a member which absorbs heat, or the conduction direction of heat. To the direction of a member which absorbs heat, or the conduction direction of heat, since the direction of the fiber of a carbon fiber is parallel, it calls it for short a following 0-degree sheet. In order for it to hold the reinforcement of the member itself that a series of layers by which the laminating was carried out at **45 degrees to the direction of a member which absorbs heat, or the conduction direction of heat are included, it is required for the inner layer section.

[0008] By the way, the direction of a member which absorbs heat, or the layer which consists of a carbon fiber prepared so that the direction of the fiber of a carbon fiber might become **45 degrees to the conduction direction of heat that a series of layers by which the laminating was carried out are included For example, the sheet made from a carbon fiber with which the direction of the fiber of a carbon fiber has been arranged at -45 degrees to the direction of a member which absorbs heat, or the conduction direction of heat It says that the layer which consists of a sheet made from a carbon fiber with which the direction of the fiber of a carbon fiber has been arranged at +45 degrees to the direction of a member which absorbs heat through 0-degree sheet, without [/or] minding, or the conduction direction of heat is included further at least. In addition, the sheet made from a carbon fiber with which the direction of the fiber of a carbon fiber has been arranged at +45 degrees to the direction of a member which calls the sheet made from a carbon fiber with which the direction of the fiber of a carbon fiber has been hereafter arranged at -45 degrees to the direction of a member which absorbs heat, or the conduction direction of heat -45-degree sheet, and absorbs heat, or the conduction direction of heat is called +45-degree sheet.

[0009] Here, + means the thing which the direction of fiber lengthens to an upward slant to the right and by which it was arranged with it at the include angle of 45 degrees to the center line of the direction of a member which absorbs heat, or the conduction direction of heat, and - means the thing which the direction of fiber lengthens to a left riser and by which it was arranged with it at the include angle of 45 degrees to the center line of the direction of a member which absorbs heat, or the conduction direction of heat. If the example of a laminating of the layer of the inner layer section is given, that by which the laminating was carried out in the order of 0-degree sheet, +45-degree sheet, 0-degree sheet, -45-degree sheet, and 0-degree sheet will be mentioned. According to the application of the member for heat sinks, the thickness of the inner layer section within limits to which the inner layer section can occupy 40 - 25% of the whole When using a thing thick as the inner layer section, what carried out the laminating in the order of for example, 0-degree sheet, +45-degree sheet, 0-degree sheet, -45-degree sheet, 0-degree sheet, 0-degree sheet, +45-degree sheet, 0-degree sheet, -45-degree sheet, and 0-degree sheet is [that what is necessary is just to choose suitably] usable. The direction of a member where the above-mentioned example of a laminating is instantiation to the last, and the inner layer section absorbs heat at least, Or the layer which consists of a carbon fiber prepared so that the direction of the fiber of a carbon fiber might become **45 degrees to the conduction direction of heat contains a series of layers by which the laminating was carried out. As long as the laminating is carried out so that the configuration of the whole layer may serve as mirror symmetry on both sides of a center line parallel to the direction of a member which absorbs the heat of said division material, or the conduction direction of heat, and it may consist of structure by which the laminating was carried out, the laminating may be carried out by what kind of built-up sequence. Of course, depending on the application of the member for heat sinks, a cross is used instead of 0-degree sheet.

[0010] In order to consider as the structure by which the laminating was carried out so that two or more layers which consist of a different carbon fiber on both sides of a center line parallel to the direction of a member which absorbs heat may serve as mirror symmetry The direction of a member which absorbs one layer of surface sections, and heat, Or two pars intermedia material which has the same lamination which consisted of the inner layer sections containing a series of layers by which the laminating was carried out from the layer which consists of a carbon fiber lengthened and arranged so that the direction of the fiber of a carbon fiber might become **45 degrees to the conduction direction of heat is used. the field which forms the inner layer section outside becomes facing each other mutually about the layer

which forms the surface section -- as -- a carbon system adhesives layer -- minding -- superposition -- you may prepare. Or the member which constitutes the inner layer section and the surface section is prepared independently, respectively, and through a carbon system adhesives layer, the member which constitutes the inner layer section from a member which constitutes the two surface sections may be made to pinch, and may be prepared. Of course, even if it carries out a laminating much more further and prepares one by one, it does not interfere. If the laminating is carried out so that the layer which constitutes a member may serve as mirror symmetry, if it puts in another way, the formation approach of lamination does not necessarily have a special limit. Press working of sheet metal of the layered product prepared in this way is carried out, and a Plastic solid is acquired.

[0011] In case Cu is infiltrated, the above-mentioned Plastic solid Temperature suitable in nitrogen-gas-atmosphere mind, For example, when it is made to calcinate at 2000 degrees C, the acquired baking object, i.e., a C/C composite and Cu powder, is heated in the same furnace, without making it contact mutually and Cu powder fuses What is necessary is to infiltrate into a C/C composite the copper which applied to which and fused the high-pressure force to coincidence, and just to cool immediately, while contacting both. Or what is necessary is to infiltrate into a baking object the copper which applied to which and fused the high-pressure force to coincidence, and just to cool immediately, while contacting both, when the baking object (C/C composite) and Cu powder which were prepared beforehand are heated in the same furnace, without making it contact mutually and Cu powder fuses. As for a carbon fiber and Cu, it is desirable to apply a carbon fiber with at least one kind of metal which was smeared, and was beforehand chosen from Be, aluminum, Si, Mg, Ti, and nickel as wettability amelioration material of copper and a carbon fiber before baking since the sex was not good. The amount of these metals used is to a maximum of 1 % of the weight to a carbon fiber. In addition, since it can perform sinking [of Cu] in by the approach indicated by the Japanese-Patent-Application-No. No. 265131 [ten to] specification concerning the application on September 18, Heisei 10 of one person's NGK Insulators, Ltd. of an applicant, it quotes it by reference here.

[0012] Therefore, the composite material into which Cu which is a heat sink member usable as an electronic substrate module for electronic equipment concerning this invention was infiltrated can be defined as the composite material which consists of a matrix which consists of Cu of the frame section which consisted of carbon components other than the carbon fiber which has specific lamination, and a carbon fiber, and the surface section of this frame section which Cu was infiltrated into the maximum surface section and formed in it at least. Usually, as for a member, carbon occupies 65 % of the weight - 85 % of the weight, and the remainder consists of Cu or a copper alloy. In addition, at least one kind of metal chosen from Be, aluminum, Si, Mg, Ti, and nickel which are used as wettability amelioration material of copper and a carbon fiber in addition to the above, calcium, Ag, Cd, Zn, Au, Pd, Ga, Pt, Cr, germanium, Rh, Sb, Ir, Co, As, Zr, Fe, Sn, nickel, P, Pb, etc. by which have been contained as an unescapable impurity may be included. It is formed in one, and at least 300 W/m-K, thermal conductivity is 500 or more W/m-K, and specific gravity's is as lightweight as 1.9 - 2.9 g/cm3 more than 400W/m and K preferably, and said matrix and said frame section are a member with high thermal conductivity.

[0013] Moreover, the C/C composite by which each carbon fiber is constituted from a carbon fiber bundle is used for the composite material into which Cu useful as a member for heat sinks concerning this invention was infiltrated as the frame section, and since the structure as a carbon fiber is held without being destroyed, it has the description that the mechanical strength which the C/C composite which constitutes the frame section has is held mostly. And it has the composite construction by which the matrix which consists of Cu was formed in the opening on the front face of the maximum of the surface section at least. in addition, the electronic substrate module for electronic equipment with which various equipments are equipped -- especially -- the altitude of 90km or more -- at most -- whenever -- space -- using it -- having -- a heat sink -- a function -- having -- electronic equipment -- ** -- what is necessary is just to process it according to each basic specification, in order to use it as an electronic substrate

[0014]

[Example] Although the example of manufacture of the member for heat sinks concerning this invention is given to below and this invention is explained to it, it cannot be overemphasized that it can embellish and change within limits which this invention is not restricted at all by this example of manufacture, and do not deviate from the meaning of this invention.
[0015] (Example of manufacture) Phenol resin was infiltrated into what lengthened and arranged the carbon fiber with the one direction, the fiber bundle (yarn) was acquired for carbon continuous glass fiber with a diameter of 10 micrometers in the about 10,000 bundle, the yarn array object (prepreg sheet) which made this yarn the shape of ** was made, and need number-of-sheets preparation of 0-degree sheet whose thickness is 150 micrometers, +45-degree sheet, and the -45-degree sheet was carried out from this thing, respectively. As the inner layer section, what carried out the laminating in the order of 0-degree sheet, +45-degree sheet, 0-degree sheet, -45-degree sheet, and 0-degree sheet was used. The laminating of the two surface sections which prepared three 0-degree sheets in piles on both the front faces of this inner layer section was carried out so that the surface section might be arranged on each front face, carbon system adhesives were applied from on this layered product, and yarn was fixed. The fixing object was made to release from mold from a mold after fixing, and after stiffening the phenol resin which puts in and infiltrated the layered product into oven by 180 degrees C and ordinary pressure, it calcinated at 2000 degrees C in nitrogen-gas-atmosphere mind.
[0016] Subsequently, when this acquired baking object and Cu powder were heated in the same furnace, without making it contact mutually and Cu powder fused, while contacting both, the baking object was infiltrated, it cooled immediately, the copper which applied to which and fused the high-pressure force to coincidence was manufactured, and the member for heat sinks was prepared. The thermal conductivity of this thing is 350 W/m-K, specific gravity is 2.5 g/cm3, and it is ******. From this thing, the electronic substrate for electronic equipment which has a heat sink function was manufactured according to standard specifications. When examined about thermal conductivity, very good thermal conductivity was shown.
[0017]
[Effect of the Invention] Since the frame section consists of carbon fibers, the member for heat sinks concerning this invention is lightweight, and its thermal conductivity is also high. Since the surface section which consists of carbon fiber bundles put in order in parallel to the direction of a member which absorbs heat, or the conduction direction of heat is especially prepared in the front face, it has the outstanding special feature that it can move in the direction of a member where heat absorbs heat from a front face, or the conduction direction of heat in an instant. since the frame section consists of C/C composites especially and it is rich also in thermal resistance -- the altitude of 90km or more -- at most -- whenever -- space -- using it -- having -- various kinds -- equipments -- equipping -- having -- electronic equipment -- ** -- an electronic substrate -- ** -- a module -- ****** -- suitable -- being usable .

[Translation done.]

* NOTICES *

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the mimetic diagram showing an example of the layer structure of the member for heat sinks concerning this invention.
[Description of Notations]
1 -- The surface section, 2 -- The inner layer section, 3 -- -45-degree sheet, 4--0-degree sheet, 5--+45-degree sheet.

[Translation done.]

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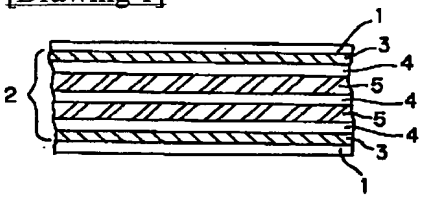
DRAWINGS

[Drawing 1]



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